and 79 parts nitrogen, 53.28^{cc} was evolved by intramolecular respiration, and no. 2, 71.58^{cc}, of which 57.91^{cc} came from the same source.

If 0.21 of the atmospheric air in the eudiometer at the beginning of the experiment was oxygen, and 0.79 nitrogen, then no. 1 must have contained 51.67^{cc} and no. 2 51.44^{cc} of nitrogen. Now at the close of the experiment, assuming that no other gas was present, no. 1 contained 32.49^{cc} and no. 2, 26.92^{cc} nitrogen; therefore 19.18^{cc} of nitrogen must have escaped from no. 1, and 24.52^{cc} from no. 2. On the assumption that the gases were completely diffused, the nitrogen that escaped from the first eudiometer must have carried with it 26.65^{cc}, and that from the second 38.62^{cc} of carbonic acid gas. This shows that from the seeds in the first eudiometer 79.93^{cc}, and in the second 96.53^{cc} of carbonic acid gas must have been evolved by intramolecular respiration.

To explain this apparent discrepancy between the two results, it should be stated that germination had not proceeded so far in no. 1 as in no. 2; in the former the sprouts on the seeds were from 2 to 4^{mm}, and in the latter from 4 to 6^{mm} in length. Slight decomposition had taken place in both eudiometers, but no fungus was visible in either.—T. C. JOHNSON, *West Virginia University*.

NOTES ON AQUILEGIA CANADENSIS LINN. AND A. VULGARIS LINN.

FOR several years I have had growing in my dooryard a patch each of our common eastern columbine and of the European or garden species, and have found them a fruitful source of pleasure and study. I wish to record a few of the more interesting observations. When the buds develop in the axils of the leaves, they at first stand erect, but soon begin to droop, and by the time the flowers begin to expand they hang completely inverted. As soon as the pollen has been shed and the ovaries have been fertilized, the flowers begin gradually to resume the erect position, and by the time the outer whorls have fallen the five-parted ovaries are standing erect, ready to mature, dehisce, and scatter the seeds. This rapid change in the position of the flowers is made possible by the great and rapid changes in the length and thickness of the peduncles. At first they are about one-fourth inch long and very slender; by the time the flowers have fallen and the ovaries are standing erect the peduncles have grown to be three to five inches long, and are thick rigid stems. This entire change takes place in about five days.

As soon as the petals separate at the apex, the five styles protrude and are ready to receive the pollen from other flowers, and before the anthers in the same flower are ready to shed pollen. The numerous stamens stand straight, around the pistil, except while the flowers first open and while the pistil is receiving pollen. At this time the outer ends of the filaments are bent outwards and away from the pistil at an angle of about 45°. As the innate anthers mature, however, and are ready to shed pollen, the filaments gradually assume the erect position. The pistils of the same flower by this time have had ample opportunity to receive pollen from other flowers. The stamens are from one-eighth to one-half inch shorter than the mature pistils. Hence close pollination is avoided by the protogynous condition of the flower, and by the stamens being shorter than and turned away from the stigmas.

The form and disposition of the spurs is quite different in the two species. In *A. Canadensis* the spurs are straight, while in *A. vulgaris* the outer end is curved inwards until it is again bent back on itself, forming an entire ring or circle. In *A. Canadensis* the spurs are longer and more slender and the tissues more tender. In both the nectary is located in the outer end of the spur, where it is represented by a hard nodule or gland. The common ruby-throated humming bird (*Trochilus colubris* L.), the tobacco and tomato sphinx moths (*Macrosila carolina* L. and *M. 5-maculata* Harr.) are common visitors to *A. Canadensis*, but I have never seen them visit *A. vulgaris*.[1] They take nectar by inserting the bill or tongue into the hollow of the spur, while the flower is still hanging in the inverted position. The body of the bird or insect is poised in the air by the rapid motion of the wings. This disturbs the air in the neighborhood violently, and so scatters the pollen widely in all directions.[2] In both species the Virginia carpenter-bee (*Xyocopa Virginica* L.) and a small bee (*Odynerus foraminatus* Sauss.) slit the tube of the spur, and take the nectar direct from the gland. Later, the honey bee (*Apis mellifica* L.) and a green bee (*Agapostemon radiatus* Say) enter these slits and secure the remaining nectar, but they do not make new slits themselves.—J. SCHNECK, *Mt. Carmel, Ill.*

[1] Perhaps for the reason that the curvature of the spurs of *A. vulgaris* renders it impossible for them to reach the nectar by the usual route.

[2] The inverted position of the flowers at this time renders it impossible for the pollen to fall into the open mouths of the spurs, and so be lost and useless to the flowers for pollination.